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The Files - Project 2153

23 March 1959

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Trip Report - Photographic Encipher System

1. On 17 February 1959 the undersigned visited the [REDACTED] New York, to discuss technical problems connected with this project. Participating in these discussions were:

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[REDACTED]  
[REDACTED]  
[REDACTED] STS/AF  
[REDACTED] OC-S  
[REDACTED] OC-E/R+D-EP

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2. One of the anticipated problems in the photographic encipher system was that of registration, or proper alignment, of the different negatives. [REDACTED] however, felt that registration would present relatively insignificant problems, and that the techniques used by [REDACTED] would be directly applicable. For registration of most of their color printing work, [REDACTED] utilizes finely drawn crosses placed at diagonally located corners of the page. These crosses are aligned visually, and the resulting registration appears to be very good. For the photographic encipher system, a mechanical method of registration might be more desirable. [REDACTED] representatives believed that precision-punched holes in the film base would serve to locate the negatives on metal pegs with sufficient accuracy, providing the film base were strong enough. They estimated that a film base of 6-mil mylar would be adequate to insure proper alignment with this method of registration.

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3. [REDACTED] has developed an autopositive film which may be applicable to the photographic encipher system. The color of this film can be pushed back and forth between yellow and blue before development. With exposure to white light, the film turns yellow, and with exposure to ultraviolet light, the film returns to blue. This color reversal can be repeated indefinitely until final fixation by development. In application, the film would be first exposed to ultraviolet to turn it blue. Then, using yellow light, the key material and the plain text would be projected separately, as in a double exposure, onto the autopositive film. Next, the plain text and key text would be aligned together, and the resultant image would be projected with ultraviolet light onto the autopositive film. The result, after development, would be cipher text. [REDACTED] was definitely interested

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in the cipher system and the possible applicability of their product to the system. They indicated that they would continue investigation along the lines discussed during the visit and would inform us of the results and conclusions.

4. On 18 February 1959 the undersigned visited the [REDACTED] [REDACTED], St. Paul, Minnesota, to discuss the photographic encipher system with [REDACTED] technical people and to determine the applicability of their products for the system. Present at the discussions were:

[REDACTED]  
SPS/AF  
OC-S  
OC-E/R+D-EP

5. The [REDACTED] has developed a transparent Thermo-Fax paper which has been examined for possible use in the cipher system. The principle difficulty is that the Thermo-Fax transparency cannot be used to make a negative or a positive of itself, since re-exposure to heat (the Thermo-Fax reaction is entirely dependent on heat) turns the entire copy black. The possibility of finding some way around this difficulty has not been overlooked.

[REDACTED] and [REDACTED] are investigating the problem, but it appears at this time that [REDACTED] does not have a product which would be used in the cipher system.

6. On 24 February 1959 the writer visited the [REDACTED] New Orleans, Louisiana, to discuss the photographic encipher system with particular regard to the possible utilization of [REDACTED] photographic products in the system. Participating in the discussions were:

[REDACTED]  
SPS/AF  
OC-S  
OC-E/R+D-EP

7. [REDACTED] manufactures and sells a photographic paper, [REDACTED] which appears very promising for use in the cipher system. [REDACTED] consists of a transparent emulsion on a mylar base. Upon exposure to ultra-violet light, the emulsion decomposes to form microscopic light-scattering spheres. The film is then developed by the application of heat, which serves to bring out the image and to fix the film, making the print stable. A visible image is produced only after emulsion has been sensitized

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25X1A5a1 by the ultraviolet light and then developed by the application of heat. Furthermore, [ ] can be momentarily exposed to white light, without resultant sensitization of the emulsion, and the mylar used in the base exhibits a high degree of dimensional stability.

25X1A5a1 8. With [ ] it might even be possible to produce the finished cipher copy from a sandwich construction of the key text, plain text, and blank [ ] sheet, thereby eliminating most problems of registration. This method, illustrated on the attached sheet, has four steps: 25X1A5a1 (1) a sandwich construction is formed with a blank sheet of unsensitized (unexposed) [ ] between the key text and the plain text; (2) the sandwich is exposed to ultraviolet light from both directions, sensitizing those areas struck by the light; (3) the sandwich is exposed to infrared light from both directions, causing localized heating of those areas contacting black printed material, and causing development and fixation of those areas which are both sensitized and in contact with black printed material; and (4) the insecure cipher copy resulting from step 3 is used to make a negative of itself which is secure cipher copy. The last step is necessary because the undeveloped sensitized areas of the insecure cipher copy will retain their latent ultraviolet image for some time, which would allow the cipher to be analyzed and broken. 25X1A5a1 [ ] felt that there was a definite possibility that the [ ] paper could be used in the photographic encipher system and 25X1A5a1 indicated that [ ] would undertake an investigation of the problems involved and inform the undersigned of their results and conclusions.

25X1A5a1 9. The [ ] proposal for a study program to determine the applicability of the [ ] printing medium for the photographic encipher system has been judged satisfactory and has been accepted. Work under this task order, as well as the association of the Agency with the contract, shall be classified SECRET. 25X1A5a1

#### 10. Summary and Future Plans

25X1A5a1 Both [ ] are undertaking company-sponsored studies to determine applicability of their products in the photographic encipher system. The possibilities of both companies coming up with a useable system appear to be very good. In the meantime, [ ] has been contracted to perform a Government-sponsored feasibility study on the cipher system and the application of their [ ] process in the system. R&D investigation of further photographic techniques which might serve the purpose is also continuing. On 13 March 1959 the undersigned, along with Messrs. [ ] will confer with representatives from the [ ] 25X1A5a1 One of the recent developments of this company is a paper coated with microscopic dye-filled gelatin globules. The dye within these globules can be changed from blue to colorless and back again by exposure to different light frequencies. This reversal process within the metachromatic dyes can be repeated indefinitely as

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long as the globules remain unbroken. With the application of pressure, the globules are burst and the dye is permanently fixed at that color which it possessed at the time of globule breakage. This paper may have possibilities for the cipher system. A full report will be made on the results of the conference.



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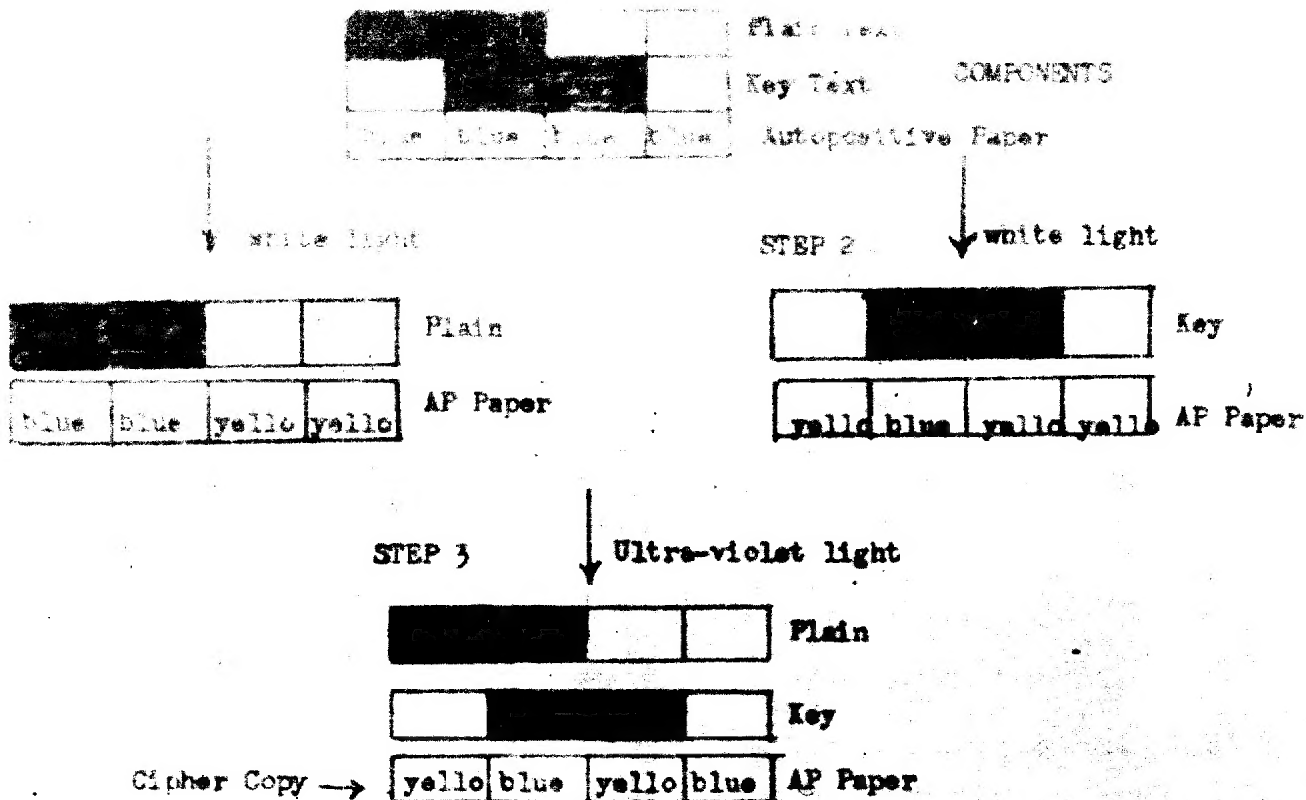
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Proposed Process

STEP 1: Sandwich Construction



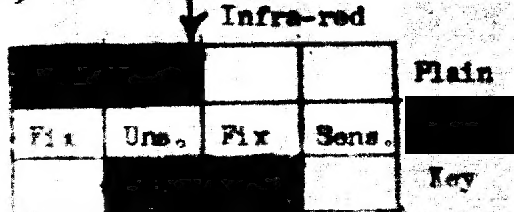
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STEP 2: Ultra-violet



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STEP 3: Infra-red



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STEP 4: Ultraviolet



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Heat Application

Cipher Copy →



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Note: The fixed image appears white when viewed by reflected light.

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